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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/594,619

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Akimasa Tanaka

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EXAMINER

GARRITY, DIANA C

ART UNIT

PAPER NUMBER

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/594,619

**Applicant(s)**

TANAKA, AKIMASA

**Examiner**

DIANA C. GARRITY

**Art Unit**

2814

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 06 April 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1, 3 and 6-20 is/are pending in the application.
- 4a) Of the above claim(s) 11-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 3, and 6-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-8508)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### *Status of Claims*

**1. Amendment filed April 6, 2009 is acknowledged.**

- Claims 2, 4, and 5 have been cancelled.
- Claims 1, 3, and 6-20 are pending.
  - Claims 11-20 have been withdrawn from consideration.
  - Claim 1 has been amended.
  - Claims 1, 3, and 6-10 are examined below.
    - Claims 1, 3, and 6-10 are rejected.

### *Continued Examination Under 37 CFR 1.114*

**2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection.** Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submissions filed on April 6, 2009 and April 29, 2009 have been entered.

### *Response to Arguments*

**3. Applicant's arguments with respect to claim 1 have been considered but are moot in view of the new ground(s) of rejection.**

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**4. Claims 1, 3, 6, 8, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gaalema of record (US 4,507,674) in view of Yutaka et al. (JP 3-104287) of record.**

*Regarding claim 1*, Gaalema (Figure 1) teaches a photodetector device comprising:

- a multilayer structure (10) including a plurality of compound semiconductor layers (18 and 20) laminated and having first and second main faces opposing each other;
- a photodetecting region (19) formed near the first main face within the multilayer structure;
- a first electrode (16) arranged on the first main face of the multilayer structure and electrically connected to the photodetecting region (column 4, ln 60 - column 5, ln 6);
- a second electrode (28) arranged on the second main face of the multilayer structure and electrically connected to the first electrode (14, 16);
- a third electrode (26) arranged on the second main face of the multilayer structure and electrically connected to a part near the second main face in the multilayer structure; and

a light transmitting layer (12), optically transparent (column 4, ln 56-59) to incident light and arranged on the first main face of the multilayer structure, covering the photodetecting region and first electrode,

wherein the light-transmitting layer includes a film made of silicon oxide and a glass substrate (column 10, ln 65 - column 11, ln 8; silicon oxide is glass),

wherein the glass substrate is secured to the multilayer structure through the film made of silicon oxide (the glass itself is attached to itself, which is attached to the multilayer structure),

wherein the first electrode includes a contact electrode and an electrode part, the contact electrode is formed on a front face of the photodetecting region and is electrically connected to the photodetecting region (30 and 16); and

wherein the film made of silicon oxide covers the first electrode (Figure 1) and makes the first main face of the multilayer structure flattened (Figure 1: the ultimate face of the multilayer surface, including the silicon oxide, is flat);

wherein the multilayer structure further comprises a depression (area inside 28) formed about the photodetecting region, and a wiring electrode (28) arranged within the depression;

wherein the electrode part (16) electrically connects the first electrode to the second electrode (28: top) through the wiring electrode arranged within the depression;

and

wherein the third electrode (26) is electrically connected to a part positioned near the photodetecting region in the high-concentration carrier layer (22 connected to 20,

which in this case corresponds to Yutaka et al. high-concentration layer 8 in order of construction).

Therefore, Gaalema is shown to teach all the limitations of claim 1 with the exception of explicitly stating:

wherein the plurality of compound semiconductor layers includes a high-concentration carrier layer of a first conductive type, a light-absorbing layer of the first conductive type, and a cap layer of the first conductive type, wherein the photodetecting region is a region of a second conductive type including at least a part of the cap layer.

However, Yutaka et al. teaches a photodetector device which comprises a plurality of compound semiconductor layers including a high-concentration carrier layer of first conductivity type (8), a light absorbing layer of first conductivity type (7), and a cap layer of first conductivity type (1 and 5); and wherein the photodetecting region (2) is a region of a second conductive type including at least part of the cap layer.

Therefore, it would have been obvious to construct the multilayer semiconductor region of Gaalema according to the construction set forth by Yutaka et al. for the purpose of accurately controlling the width of each layer by use of an epitaxial growth method (Abstract).

*Regarding claim 3*, Gaalema teaches the light transmitting layer includes a film made of silicon oxide or a resin (column 10, ln 65 - column 11, ln 8; silicon oxide is glass).

*Regarding claim 6*, Gaalema teaches a through lead (28) penetrating through the multilayer structure;  
wherein the first electrode (16 is electrically connected to the second electrode (28) through the lead (28); and  
wherein the third electrode (26) is electrically connected to the high-concentration carrier layer (22 connected to 20, which in this case corresponds to Yutaka et al. high-concentration layer 8 in order of construction).

*Regarding claim 8*, Gaalema teaches a light-reflecting film (26; column 8, ln 45-51), provided on the second main face, covering the photodetecting region.

*Regarding claim 9*, Gaalema teaches a plurality of photodetecting regions arranged in a row (column 3, ln 21-25).

**5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gaalema ('674) and Yutaka ('287) as applied to claim 1 above, and further in view of Fujii et al. (US 6,933,489).**

*Regarding claim 7*, Gaalema teaches the second and third electrodes include respective pad electrodes (26 and 28: flat surfaces), and that second and third electrodes are attached to further circuitry (70 and 32).

Thus, Gaalema in view of Yutaka is shown to teach all the limitations of claim 7 with the exception of bump electrodes arranged on the pad electrodes.

However, Fujii et al. teaches an analogous backlit photodetector device in which bump electrodes (B) are attached to pad electrodes (OM) for the purpose of electrically and mechanically attaching the photodetecting device to a semiconductor chip (C; column 2, ln 51-67).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to attach bump electrodes to the electrodes of Gaalema in order to reduce packaging area, and connect multiple photodetectors to a single circuit board without much loss of real estate.

**6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gaalema ('674) and Yutaka ('287) as applied to claim 1 above, and further in view of Nunogaki et al. (US 5,602,384).**

*Regarding claim 10*, Gaalema teaches the light transmitting layer (12).

Thus, Gaalema in view of Yutaka is shown to teach all the limitations of claim 10 with the exception of a lens part converging the incident light.

However, Nunogaki teaches an analogous light detector which uses a glass lens (130) to direct light into a photodetecting region (Column 25, ln 54-63).

Therefore, it would have been obvious to one of ordinary skill in the art to use a glass lens to focus the light in order to maximize radiation absorption efficiency, and to increase sensor output for light even at oblique angles (Nunogaki et al. column 25, ln 64 – column 26, ln 9).



***Conclusion***

**7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DIANA C. GARRITY whose telephone number is (571) 270-5026.** The examiner can normally be reached on Monday-Friday 7:00 AM - 3:30 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Diana C Garrity/  
Examiner, Art Unit 2814

/Phat X. Cao/  
Primary Examiner, Art Unit 2814